SEQUENCE LISTING

(1) GENERAL INFORMATION:

    (i) APPLICANT: Markussen, Jan
                   Jonassen, Ib
                   Havelund, Svend
                   Brandt, Jakob
                   Kurtzhals, Peter
                   Hansen, Hertz Per

   (ii) TITLE OF INVENTION: INSULIN DERIVATIVES

  (iii) NUMBER OF SEQUENCES: 26

   (iv) CORRESPONDENCE ADDRESS:
        (A) ADDRESSEE: Novo Nordisk of North America, Inc.
        (B) STREET: 405 Lexington Avenue, 64th Floor
        (C) CITY: New York
        (D) STATE: New York
        (E) COUNTRY: United States of America
        (F) ZIP: 10174-6401

    (v) COMPUTER READABLE FORM:
        (A) MEDIUM TYPE: Floppy disk
        (B) COMPUTER: IBM PC compatible
        (C) OPERATING SYSTEM: PC-DOS/MS-DOS
        (D) SOFTWARE: PatentIn Release #1.0, Version #1.30

   (vi) CURRENT APPLICATION DATA:
        (A) APPLICATION NUMBER: to be assigned
        (B) FILING DATE: 17-SEPT-1997
        (C) CLASSIFICATION:

 (viii) ATTORNEY/AGENT INFORMATION:
        (A) NAME: Lambiris, Elias J.
        (B) REGISTRATION NUMBER: 33,728
        (C) REFERENCE/DOCKET NUMBER: 4341.204-US

   (ix) TELECOMMUNICATION INFORMATION:
        (A) TELEPHONE: 212-867-0123
        (B) TELEFAX: 212-878-9655

(2) INFORMATION FOR SEQ ID NO:1:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 21 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:1:

Gly Ile Val Glu Gln Cys Cys Thr Ser Ile Cys Ser Leu Tyr Gln Leu
1   5   10   15

Glu Asn Tyr Cys Xaa
        20

(2) INFORMATION FOR SEQ ID NO:2:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 30 amino acids
        (B) TYPE: amino acid

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        (C)  STRANDEDNESS: single
        (D). TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:2:

   Xaa Xaa Xaa Gln His Leu Cys Gly Ser His Leu Val Glu Ala Leu Tyr
   1           5                   10                  15

   Leu Val Cys Gly Glu Arg Gly Phe Phe Xaa Xaa Xaa Xaa Xaa
               20                  25                  30


(2) INFORMATION FOR SEQ ID NO:3:

   (i)  SEQUENCE CHARACTERISTICS:
        (A)  LENGTH: 5 amino acids
        (B)  TYPE: amino acid
        (C)  STRANDEDNESS: single
        (D)  TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:3:

   Tyr Thr Pro Lys Thr
   1               5


(2) INFORMATION FOR SEQ ID NO:4:

   (i)  SEQUENCE CHARACTERISTICS:
        (A)  LENGTH: 5 amino acids
        (B)  TYPE: amino acid
        (C)  STRANDEDNESS: single
        (D)  TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:4:

   Tyr Thr Pro Lys Ala
   1               5


(2) INFORMATION FOR SEQ ID NO:5:

   (i)  SEQUENCE CHARACTERISTICS:
        (A)  LENGTH: 5 amino acids
        (B)  TYPE: amino acid
        (C)  STRANDEDNESS: single
        (D)  TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:5:

   Ser Asp Asp Ala Arg
   1               5


(2) INFORMATION FOR SEQ ID NO:6:

   (i)  SEQUENCE CHARACTERISTICS:
        (A)  LENGTH: 13 amino acids
        (B)  TYPE: amino acid
        (C)  STRANDEDNESS: single
        (D)  TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:6:

   Glu Glu Ala Glu Ala Glu Ala Glu Pro Lys Ala Thr Arg
   1               5                   10
```

(2) INFORMATION FOR SEQ ID NO:7:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 5 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:7:

Ser Asp Asp Ala Arg
1   5

(2) INFORMATION FOR SEQ ID NO:8:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 7 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:8:

Thr Lys Ser Asp Asp Ala Arg
1   5

(2) INFORMATION FOR SEQ ID NO:9:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 6 amino acids
        (B) TYPE: amino acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:9:

Lys Ser Asp Asp Ala Arg
1   5

(2) INFORMATION FOR SEQ ID NO:10:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 112 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:10:

CCAAGTACAA AGCTTCAACC AAGTGGGAAC CGCACAAGTG TTGGTTAACG AATCTTGTAG   60

CCTTTGGTTC AGCTTCAGCT TCAGCTTCTT CTCTTTTATC CAAAGAAACA CC   112

(2) INFORMATION FOR SEQ ID NO:11:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 27 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

   (xi) SEQUENCE DESCRIPTION: SEQ ID NO:11:

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TAAATCTATA ACTACAAAAA ACACATA   27

(2) INFORMATION FOR SEQ ID NO:12:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 79 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:12:

TTGGTTGAAG CTTTGTACTT GGTTTGCGGT GAAAGAGGTT TCTTCTACAC TCCTAAGTCT   60

GACGATGCTA GAGGTATTG   79

(2) INFORMATION FOR SEQ ID NO:13:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 27 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:13:

TTAATCTTAG TTTCTAGAGC CTGCGGG   27

(2) INFORMATION FOR SEQ ID NO:14:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 85 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:14:

TTGGTTGAAG CTTTGTACTT GGTTTGCGGT GAAAGAGGTT TCTTCTACAC TCCTACCAAG   60

TCTGACGATG CTAGAGGTAT TGTCG   85

(2) INFORMATION FOR SEQ ID NO:15:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 71 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single
        (D) TOPOLOGY: linear

    (xi) SEQUENCE DESCRIPTION: SEQ ID NO:15:

CACTTGGTTG AAGCTTTGTA CTTGGTTTGC GGTGAAAGAG GTTTCTTCTA CACTAAGTCT   60

GACGATGCTA G   71

(2) INFORMATION FOR SEQ ID NO:16:

    (i) SEQUENCE CHARACTERISTICS:
        (A) LENGTH: 68 base pairs
        (B) TYPE: nucleic acid
        (C) STRANDEDNESS: single

(D) TOPOLOGY: linear

        (xi) SEQUENCE DESCRIPTION: SEQ ID NO:16:

CACTTGGTTG AAGCTTTGTA CTTGGTTTGC GGTGAAAGAG GTTTCTTCTA CAAGTCTGAC   60

GATGCTAG   68

    (2) INFORMATION FOR SEQ ID NO:17:

        (i) SEQUENCE CHARACTERISTICS:
            (A) LENGTH: 66 base pairs
            (B) TYPE: nucleic acid
            (C) STRANDEDNESS: single
            (D) TOPOLOGY: linear

        (xi) SEQUENCE DESCRIPTION: SEQ ID NO:17:

CACTTGGTTG AAGCTTTGTA CTTGGTTTGC GGTGAAAGAG GTTTCTTCAA AGTCTGACGA   60

TGCTAG   66

    (2) INFORMATION FOR SEQ ID NO:18:

        (i) SEQUENCE CHARACTERISTICS:
            (A) LENGTH: 594 base pairs
            (B) TYPE: nucleic acid
            (C) STRANDEDNESS: double
            (D) TOPOLOGY: linear

        (ix) FEATURE:
            (A) NAME/KEY: CDS
            (B) LOCATION: 109..522

        (xi) SEQUENCE DESCRIPTION: SEQ ID NO:18:

CTTAAATCTA TAACTACAAA AAACACATAC AGGAATTCCA TTCAAGAATA GTTCAAACAA   60

GAAGATTACA AACTATCAAT TTCATACACA ATATAAACGA TTAAAAGA ATG AGA TTT   117
                                                        Met Arg Phe
                                                          1

CCT TCT ATT TTT ACT GCT GTT TTA TTC GCT GCT TCC TCC GCT TTA GCT   165
Pro Ser Ile Phe Thr Ala Val Leu Phe Ala Ala Ser Ser Ala Leu Ala
  5   10   15

GCT CCA GTC AAC ACT ACC ACT GAA GAT GAA ACG GCT CAA ATT CCA GCT   213
Ala Pro Val Asn Thr Thr Thr Glu Asp Glu Thr Ala Gln Ile Pro Ala
 20   25   30   35

GAA GCT GTC ATC GGT TAC TCT GAT TTA GAA GGT GAT TTC GAT GTT GCT   261
Glu Ala Val Ile Gly Tyr Ser Asp Leu Glu Gly Asp Phe Asp Val Ala
                     40   45   50

GTT TTG CCA TTT TCC AAC TCC ACC AAT AAC GGT TTA TTG TTT ATC AAT   309
Val Leu Pro Phe Ser Asn Ser Thr Asn Asn Gly Leu Leu Phe Ile Asn
             55   60   65

ACT ACT ATT GCC TCC ATT GCT GCT AAA GAA GAA GGT GTT TCT TTG GAT   357
Thr Thr Ile Ala Ser Ile Ala Ala Lys Glu Glu Gly Val Ser Leu Asp
             70   75   80

AAA AGA TTC GTT AAC CAA CAC TTG TGC GGT TCC CAC TTG GTT GAA GCT   405
Lys Arg Phe Val Asn Gln His Leu Cys Gly Ser His Leu Val Glu Ala
 85   90   95

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TTG TAC TTG GTT TGC GGT·GAA AGA GGT TTC TTC TAC ACT CCT AAG GCT        453
Leu Tyr Leu Val Cys Gly Glu Arg Gly Phe Phe Tyr Thr Pro Lys Ala
100             105                 110                 115

GCT AAG GGT ATT GTC GAA CAA TGC TGT ACC TCC ATC TGC TCC TTG TAC        501
Ala Lys Gly Ile Val Glu Gln Cys Cys Thr Ser Ile Cys Ser Leu Tyr
            120                 125                 130

CAA TTG GAA AAC TAC TGC AAC TAGACGCAGC CCGCAGGCTC TAGAAACTAA           552
Gln Leu Glu Asn Tyr Cys Asn
            135

GATTAATATA ATTATATAAA AATATTATCT TCTTTTCTTT AT                         594
```

(2) INFORMATION FOR SEQ ID NO:19:

      (i) SEQUENCE CHARACTERISTICS:
          (A) LENGTH: 138 amino acids
          (B) TYPE: amino acid
          (D) TOPOLOGY: linear

     (ii) MOLECULE TYPE: protein

     (xi) SEQUENCE DESCRIPTION: SEQ ID NO:19:

```
Met Arg Phe Pro Ser Ile Phe Thr Ala Val Leu Phe Ala Ala Ser Ser
1               5                   10                  15

Ala Leu Ala Ala Pro Val Asn Thr Thr Thr Glu Asp Glu Thr Ala Gln
            20              25                  30

Ile Pro Ala Glu Ala Val Ile Gly Tyr Ser Asp Leu Glu Gly Asp Phe
        35              40              45

Asp Val Ala Val Leu Pro Phe Ser Asn Ser Thr Asn Asn Gly Leu Leu
    50              55                  60

Phe Ile Asn Thr Thr Ile Ala Ser Ile Ala Ala Lys Glu Glu Gly Val
65              70              75                          80

Ser Leu Asp Lys Arg Phe Val Asn Gln His Leu Cys Gly Ser His Leu
            85                  90                  95

Val Glu Ala Leu Tyr Leu Val Cys Gly Glu Arg Gly Phe Phe Tyr Thr
            100             105                 110

Pro Lys Ala Ala Lys Gly Ile Val Glu Gln Cys Cys Thr Ser Ile Cys
        115             120                 125

Ser Leu Tyr Gln Leu Glu Asn Tyr Cys Asn
130                 135
```

(2) INFORMATION FOR SEQ ID NO:20:

      (i) SEQUENCE CHARACTERISTICS:
         (A) LENGTH: 4 amino acids
         (B) TYPE: amino acid
         (C) STRANDEDNESS: single
         (D) TOPOLOGY: linear

     (ii) MOLECULE TYPE: None

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:20:

Thr Gly Gly Lys
 1

(2) INFORMATION FOR SEQ ID NO:21:

        (i) SEQUENCE CHARACTERISTICS:
          (A) LENGTH: 4 amino acids
          (B) TYPE: amino acid
          (C) STRANDEDNESS: single
          (D) TOPOLOGY: linear

        (ii) MOLECULE TYPE: None

        (xi) SEQUENCE DESCRIPTION: SEQ ID NO:21:

Thr Glu Gly Lys
 1

(2) INFORMATION FOR SEQ ID NO:22:

        (i) SEQUENCE CHARACTERISTICS:
          (A) LENGTH: 4 amino acids
          (B) TYPE: amino acid
          (C) STRANDEDNESS: single
          (D) TOPOLOGY: linear

        (ii) MOLECULE TYPE: None

        (xi) SEQUENCE DESCRIPTION: SEQ ID NO:22:

Gly Asp Thr Lys
 1

(2) INFORMATION FOR SEQ ID NO:23:

        (i) SEQUENCE CHARACTERISTICS:
          (A) LENGTH: 8 amino acids
          (B) TYPE: amino acid
          (C) STRANDEDNESS: single
          (D) TOPOLOGY: linear

        (ii) MOLECULE TYPE: None

        (xi) SEQUENCE DESCRIPTION: SEQ ID NO:23:

Gly Thr Lys Ser Asp Asp Ala Arg
 1   5

(2) INFORMATION FOR SEQ ID NO:24:

        (i) SEQUENCE CHARACTERISTICS:
          (A) LENGTH: 7 amino acids
          (B) TYPE: amino acid
          (C) STRANDEDNESS: single
          (D) TOPOLOGY: linear

        (ii) MOLECULE TYPE: None

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(xi) SEQUENCE DESCRIPTION: SEQ ID NO:24:

Gly Lys Ser Asp Asp Ala Arg
1   5

(2) INFORMATION FOR SEQ ID NO:25:

        (i) SEQUENCE CHARACTERISTICS:
          (A) LENGTH: 85 base pairs
          (B) TYPE: nucleic acid
          (C) STRANDEDNESS: single
          (D) TOPOLOGY: linear

        (xi) SEQUENCE DESCRIPTION: SEQ ID NO:25:

TTGGTTGAAG CTTTGTACTT GGTTTGCGGT GAAAGAGGTT TCTTCTACAC TGGTACCAAG   60
TCTGACGATG CTAGAGGTAT TGTCG   85

(2) INFORMATION FOR SEQ ID NO:26:

        (i) SEQUENCE CHARACTERISTICS:
          (A) LENGTH: 82 base pairs
          (B) TYPE: nucleic acid
          (C) STRANDEDNESS: single
          (D) TOPOLOGY: linear

        (ii) MOLECULE TYPE: cDNA

        (xi) SEQUENCE DESCRIPTION: SEQ ID NO:26:

TTGGTTGAAG CTTTGTACTT GGTTTGCGGT GAAAGAGGTT TCTTCTACAC CGGTAAGTCT   60
GACGATGCTA GAGGTATTGT CG   82